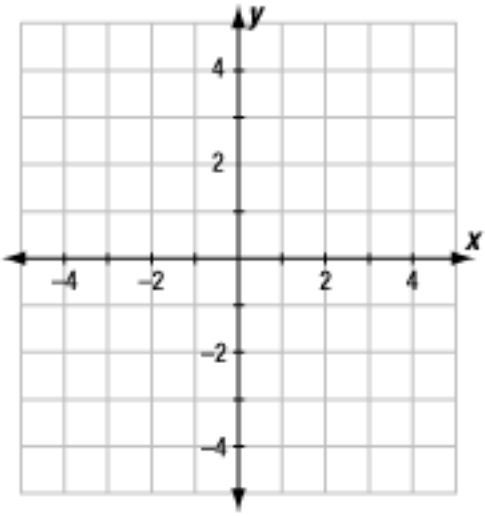
Attendance Problems. Find the area of each figure. Give exact answers, using π if necessary.

1. A square in which s = 4 m.

2. A circle in which r = 2 ft.

3. $\triangle ABC$ with vertices A(–3, 1), B(2, 4), and C(5, 1).



- I can describe the effect on perimeter and area when one or more dimensions of a figure are changed.
- I can apply the relationship between perimeter and area in problem solving.

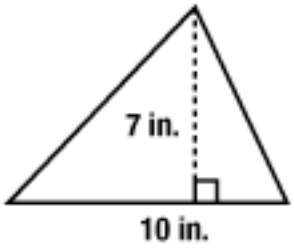
Common Core Standard: **CC.9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

In the graph, the height of each DVD is used to represent the number of DVDs shipped per year.

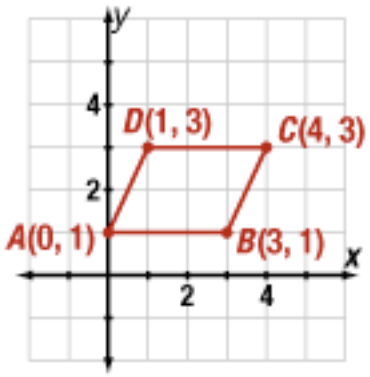
However as the height of each DVD increases, the width also increases, which can create a misleading effect.

<u>Video Example 1</u>: Describe the effect of each on each area.

the height of the triangle is doubled



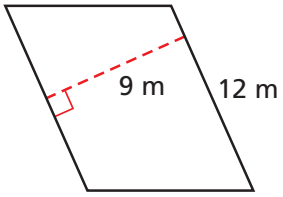
the base length of the parallelogram is multiplied by $\frac{1}{2}$



1 Effects of Changing One Dimension

Describe the effect of each change on the area of the given figure.

A **The height of the parallelogram is doubled.**



original dimensions:

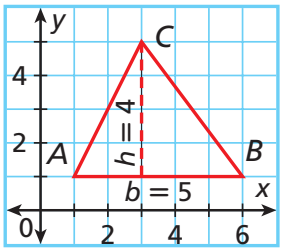
$$A = bh = 12(9)$$
$$= 108 \text{ cm}^2$$

double the height:

$$A = bh = 12(18)$$
$$= 216 \text{ cm}^2$$

Notice that $216 = 2(108)$. If the height is doubled, the area is also doubled.

B **The base length of the triangle with vertices $A(1, 1)$, $B(6, 1)$, and $C(3, 5)$ is multiplied by $\frac{1}{2}$.**



Draw the triangle in a coordinate plane and find the base and height.

original dimensions:

$$A = \frac{1}{2}bh = \frac{1}{2}(5)(4) = 10 \text{ units}^2$$

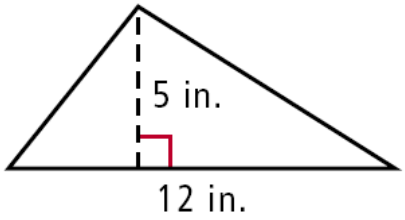
base multiplied by $\frac{1}{2}$:

$$A = \frac{1}{2}bh = \frac{1}{2}(2.5)(4) = 5 \text{ units}^2$$

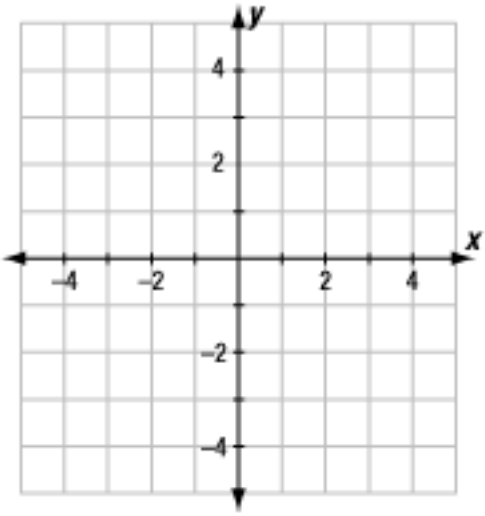
Notice that $5 = \frac{1}{2}(10)$. If the base length is multiplied by $\frac{1}{2}$, the area is multiplied by $\frac{1}{2}$.

Example 1.

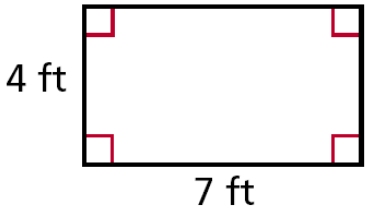
A. Describe the effect on the area of a triangle if the height is multiplied by 6.



B. The diagonal $\overline{SU}$ of the kite with vertices $R(2, 2)$, $S(4, 0)$, $T(2, -2)$, and $U(-5,0)$ is multiplied by $\frac{1}{3}$.



4. <u>Guided Practice</u>: The height of the rectangle is tripled. Describe the effect on the area.

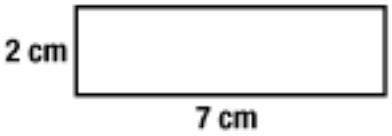


Helpful Hint

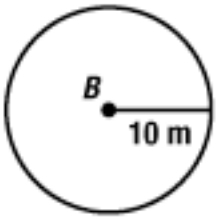
If the radius of a circle or the side length of a square is changed, the size of the entire figure changes proportionally.

<u>Video Example 2</u>: Describe the effect of each change on the perimeter or circumference and the area of the given figures.

the length and width of the rectangle are both multiplied by 3



the radius of $\odot B$ is multiplied by $\frac{1}{5}$



2 Effects of Changing Dimensions Proportionally

Describe the effect of each change on the perimeter or circumference and the area of the given figure.

A **The base and height of a rectangle with base 8 m and height 3 m are both multiplied by 5.**

original dimensions:

$P = 2(8) + 2(3) = 22$ m — *$P = 2b + 2h$*

$A = 83 = 24$ m^2 — *$A = bh$*

dimensions multiplied by 5:

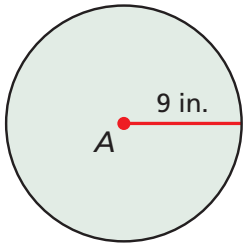
$P = 2(40) + 2(15) = 110$ m — *$5(8) = 40;\ 5(3) = 15$*

$A = 40(15) = 600$ m^2

The perimeter is multiplied by 5. — *$5(22) = 110$*

The area is multiplied by 5^2, or 25. — *$25(24) = 600$*

B **The radius of $\odot A$ is multiplied by $\frac{1}{3}$.**



original dimensions:

$C = 2\pi(9) = 18\pi$ in. — *$C = 2\pi r$*

$A = \pi(9)^2 = 81\pi$ in^2 — *$A = \pi r^2$*

dimensions multiplied by $\frac{1}{3}$:

$C = 2\pi(3) = 6\pi$ in. — *$\frac{1}{3}(9) = 3$*

$A = \pi(3)^2 = 9\pi$ in^2

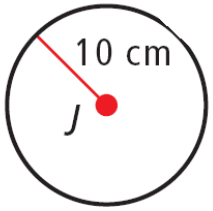
The perimeter is multiplied by $\frac{1}{3}$. — *$\frac{1}{3}(18\pi) = 6\pi$*

The area is multiplied by $\left(\frac{1}{3}\right)^2$, or $\frac{1}{9}$. — *$\frac{1}{9}(81\pi) = 9\pi$*

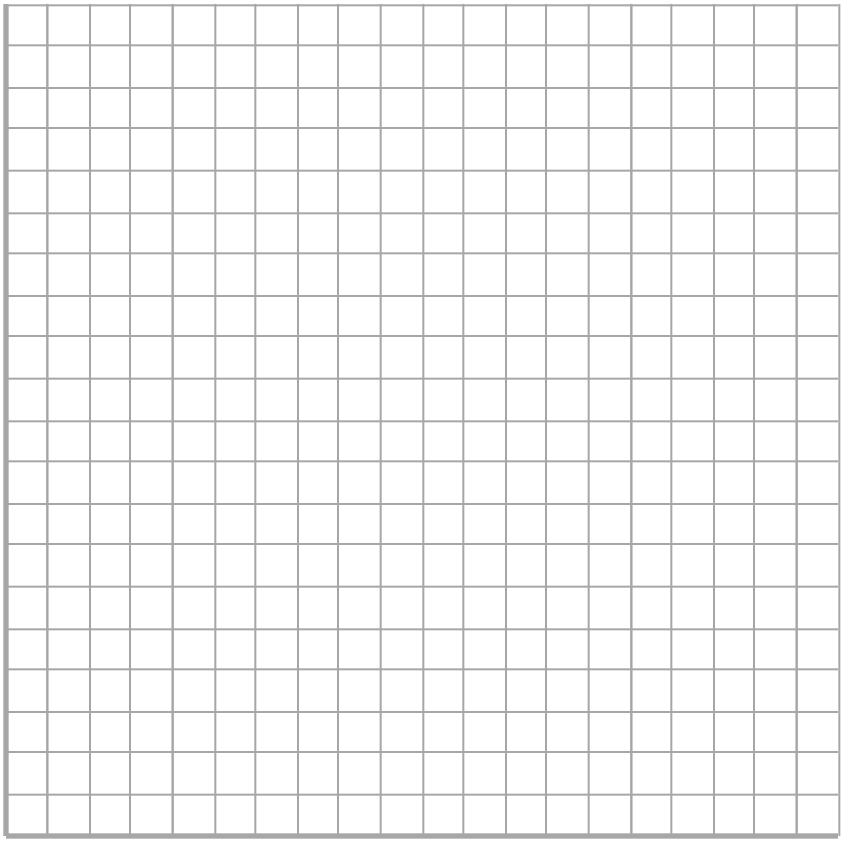
<u>Example 2</u>. Describe the effect of each change on the perimeter or circumference and the area of the given figures.

A. The base and height of a rectangle with base 4 ft and height 5 ft are both doubled.

B. The radius of $\odot J$ is multiplied by $\frac{1}{5}$.



5. <u>Guided Practice</u>: The base and height of the triangle with vertices $P(2, 5)$, $Q(2, 1)$, and $R(7, 1)$ are tripled. Describe the effect on its area and perimeter.



Fundamental Theorem of Similarity

6. When the dimensions of a shape are multiplied by a scale factor of k, what happens to the perimeter?

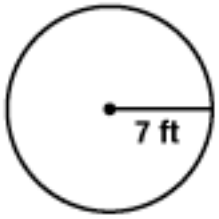
7. When the dimensions of a shape are multiplied by a scale factor of k, what happens to the area?

8. When the dimensions of a shape are multiplied by a scale factor of k, what happens to the volume?

Video Example 3

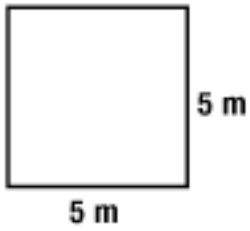
A)

A circle has radius 7 ft. If the area is multiplied by 5, what happens to the radius?



B)

A square has a side length of 5 m. If the area is tripled, what happens to the perimeter?



3 Effects of Changing Area

A **A square has side length 5 cm. If the area is tripled, what happens to the side length?**

The area of the original square is $A = s^2 = 5^2 = 25 \text{ cm}^2$.

If the area is tripled, the new area is 75 cm^2.

$s^2 = 75$ *Set the new area equal to s^2.*

$s = \sqrt{75} = 5\sqrt{3}$ *Take the square root of both sides and simplify.*

Notice that $5\sqrt{3} = \sqrt{3}(5)$. The side length is multiplied by $\sqrt{3}$.

B **A circle has a radius of 6 in. If the area is doubled, what happens to the circumference?**

The original area is $A = \pi r^2 = 36\pi \text{ in}^2$, and the circumference is $C = 2\pi r = 12\pi$ in. If the area is doubled, the new area is $72\pi \text{ in}^2$.

$\pi r^2 = 72\pi$ *Set the new area equal to πr^2.*

$r^2 = 72$ *Divide both sides by π.*

$r^2 = \sqrt{72} = 6\sqrt{2}$ *Take the square root of both sides and simplify.*

$C = 2\pi r = 2\pi\left(6\sqrt{2}\right) = 12\sqrt{2}\pi$ *Substitute $6\sqrt{2}$ for r and simplify.*

Notice that $12\sqrt{2}\pi = \sqrt{2}(12\pi)$. The circumference is multiplied by $\sqrt{2}$.

Example 3.

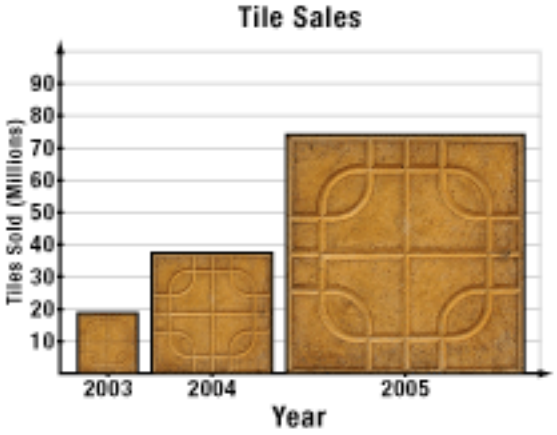
A. A circle has a circumference of 32π in. If the area is multiplied by 4, what happens to the radius?

B. An equilateral triangle has a perimeter of 21m. If the area is multiplied by $\frac{1}{2}$, what happens to the side length?

5. <u>Guided Practice</u>: A square has a perimeter of 36 mm. If the area is multiplied by $\frac{1}{2}$, what happens to the side length?

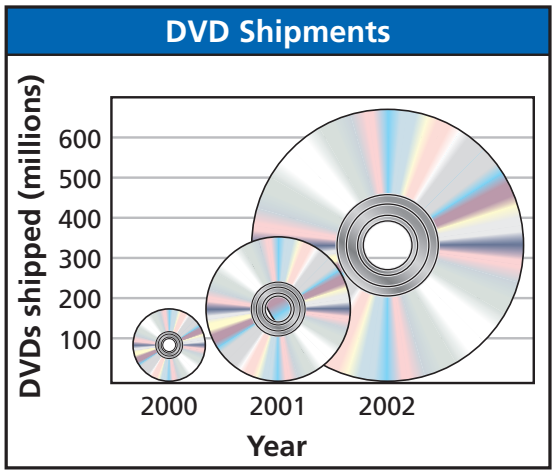
Video Example 4.

A tile manufacturer is exhibiting its tile sales in a graph that shows that sales totaled about 19 million in 2003, 38 million in 2004, and 76 million in 2005. The height of each tile is used to represent the number of tiles sold. Explain why the graph is misleading.



4 Entertainment Application

The graph shows that DVD shipments totaled about 182 million in 2000, 364 million in 2001, and 685 million in 2002. The height of each DVD is used to represent the number of DVDs shipped. Explain why the graph is misleading.

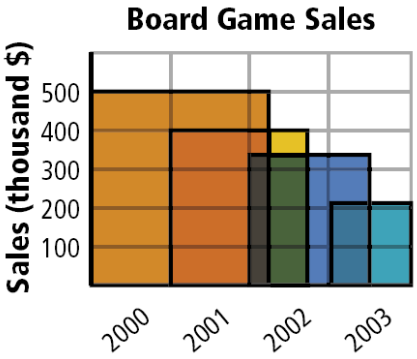


The height of the DVD representing shipments in 2002 is about 3.8 times the height of the DVD representing shipments in 2002.

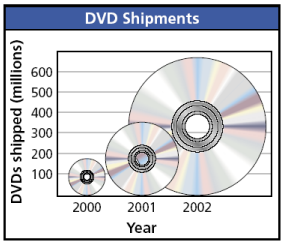
This means that the area of the DVD is multiplied by about 3.8^2, or 14.4, so the area of the larger DVD is about 14.4 times the area of the smaller DVD.

The graph gives the misleading impression that the number of shipments in 2002 was more than 14 times the number in 2000, but it was actually closer to 4 times the number shipped in 2000.

Example 4. Explain why the graph is misleading.



6. Guided Practice: Create a version of the graph that is not misleading.



10-5 Effects of Changing Dimensional Proportionally *(p 713)* 8-14, 26, 29.